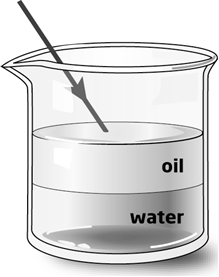
**Optics Unit Review**

Use your textbook and your class notes.

1. Complete the following table:

|  |  |  |
| --- | --- | --- |
| Mirror/Lens | Ray Diagram Steps | Properties and Applications |
| Plane Mirror |  |  |
| Concave / Converging Mirror |  |  |
| Convex / Diverging Mirror |  |  |
| Concave / Converging Lens |  |  |
| Convex / Diverging Lens |  |  |

1. The beaker to the right contains water (n=1.33) and oil (n=1.47). Draw the refraction of a ray crossing through each boundary.



1. Calculate the speed of light in a diamond with an index of refraction of 2.42.
2. Using a diagram, compare the following waves of the electromagnetic spectrum. For each part, note which has the more energy.
   1. Ultraviolet vs Infrared
   2. Radio vs Gamma
   3. Visible Light vs X-Ray
3. What is the difference between a real image and a virtual image?
4. Name all the different light sources you have learned and provide an example of each.
5. Define: reflection, refraction, and dispersion.
6. Explain how refraction works in terms of Fermat’s Principle.
7. You shine a laser through 2 different mediums at 45 degrees. You find the angle of refraction for medium A to be 20 degrees, and medium B to be 40 degrees. Using the power of science (or just what you have learned in optics), compare the properties of both mediums.
8. Using your understanding of optics (refraction, reflection, dispersion, etc.), list the optical phenomena you have learned and briefly described how they work.
9. What is apparent depth? Draw a diagram to demonstrate your understanding.
10. You shine a laser through a medium at 60 degrees and, to your surprise, no refraction occurs. Instead, you notice the laser reflects off the boundary between air and the medium. Once again, use the power of science to explain this phenomenon.
11. What properties of a convex mirror make it useful in a convenience store?
12. A medium has a critical angle of 45 degrees. Without doing any calculations, predict what would happen if you shine a laser with an angle of incidence of:
    1. 15 Degrees
    2. 40 Degrees
    3. 45 Degrees
    4. 50 Degrees
13. Describe the following conditions and, using terminology from the optics unit, briefly explain why a clear image is not formed:
    1. Myopia
    2. Hyperopia
    3. Presbyopia
    4. Astigmatism
14. You are stranded on an island with an unlimited supply of glass and a lens-crafting machine. Also, you have magically developed the following conditions:
    1. Myopia
    2. Hyperopia

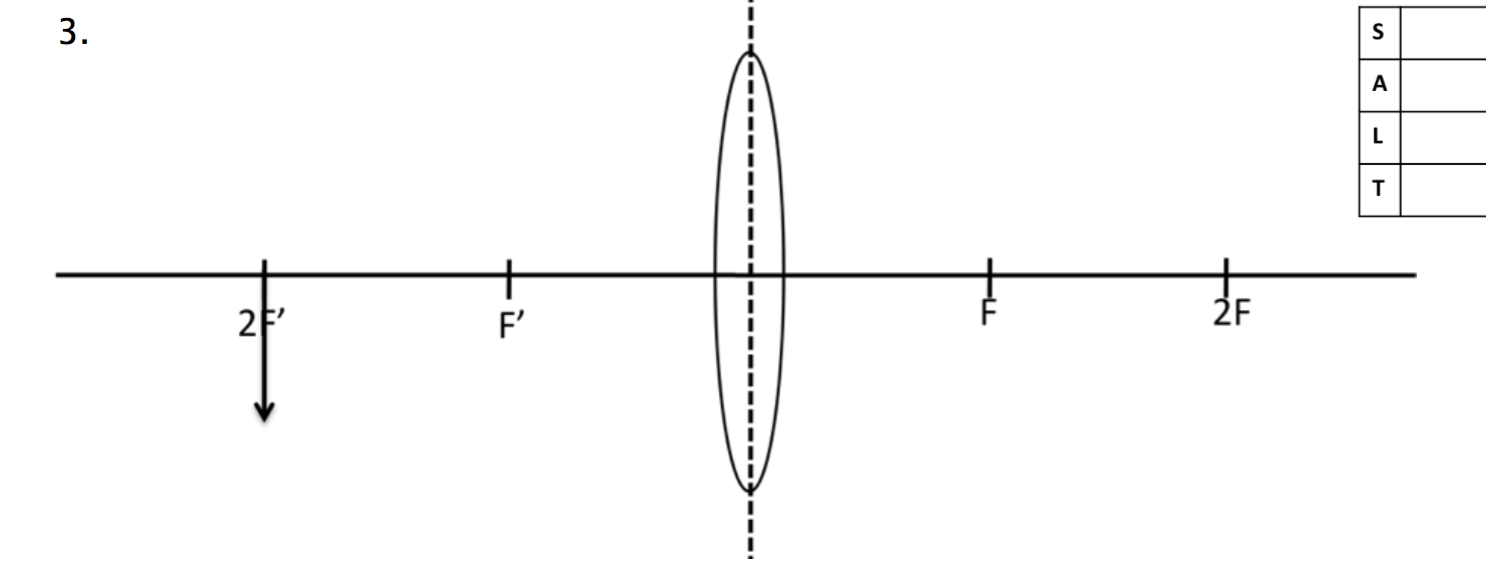
Furthermore, there are vicious giant turtle bears on this island. Oh, and their favorite food is human. In order to avoid being eaten, you recall a life-changing lesson in your Grade 10 Optics class where you were taught how to correct these conditions. How do you do it?

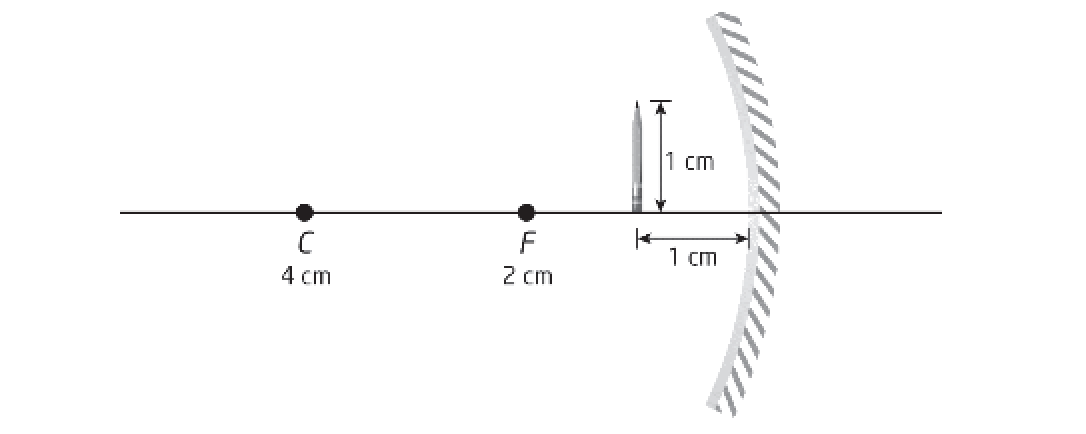
1. Briefly describe how are lenses used in the following devices:
   1. Microscope
   2. Refracting Telescopes (Galileo and Kepler)
   3. Reflecting Telescopes
2. Using terminology you have learned in this unit, explain the following:
   1. How does a prism split light?
   2. How do fiber optic cables work?
   3. How do radar dishes (concave surface) work?
3. Which mirror surface was used to produce the following images?
   1. Same distance, upright, same size, and virtual?
   2. Farther distance, inverted, larger size, and real?
   3. Closer distance, upright, smaller size, and virtual?
   4. Closer distance, inverted, smaller size, and real?
   5. No image is formed.
   6. Farther distance, upright, larger size, and virtual?
4. Which lens was used to produce the following images?
   1. Closer distance, inverted, smaller size, and real?
   2. No image formed.
   3. Farther distance, upright, larger size, and virtual?
   4. Closer distance, upright, smaller, and virtual?
5. Draw a diagram of a light ray traveling from (assume an angle of incidence that is NOT along the normal or perpendicular to the surface):
   1. Air into water
   2. Medium A (n=1.5) to Medium B (n=1.2)
   3. Air into air
   4. Oil into air
6. Describe the following:
   1. Spherical Aberration
   2. Chromatic Aberration
7. Describe how the human eye can form clear images using the appropriate terminology (ciliary muscles, lens, cornea, pupil, retina, etc.)

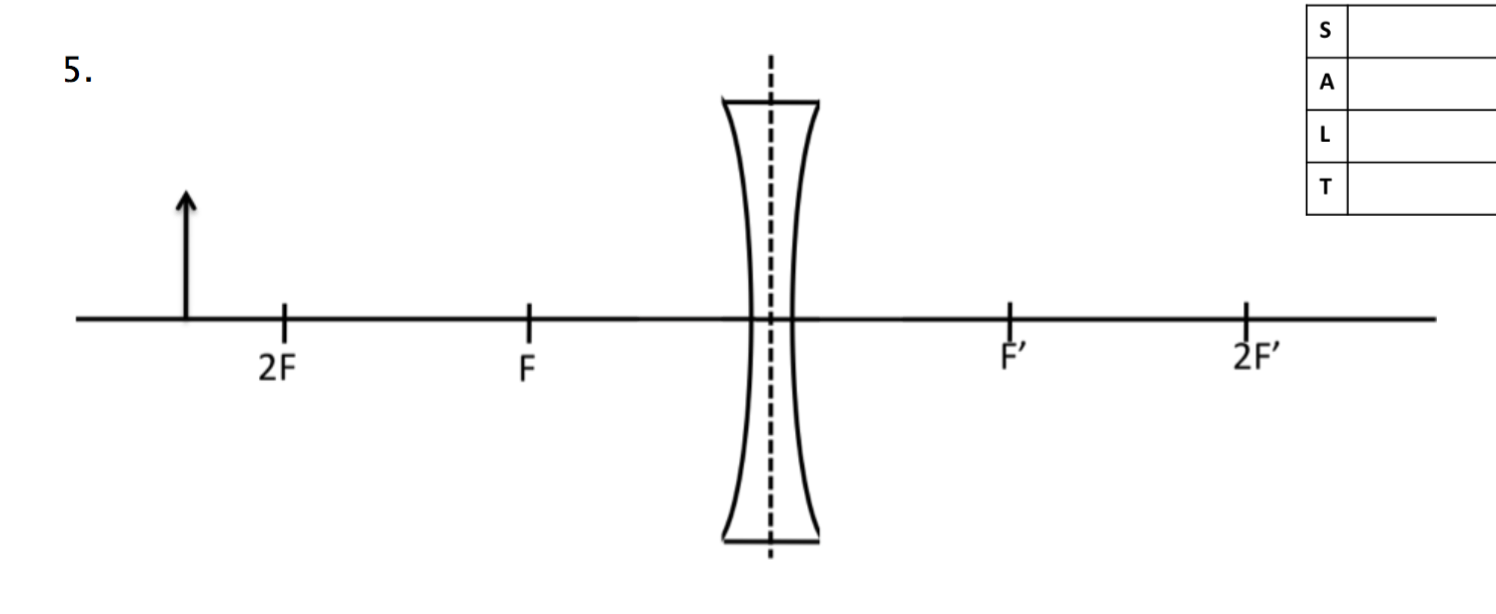
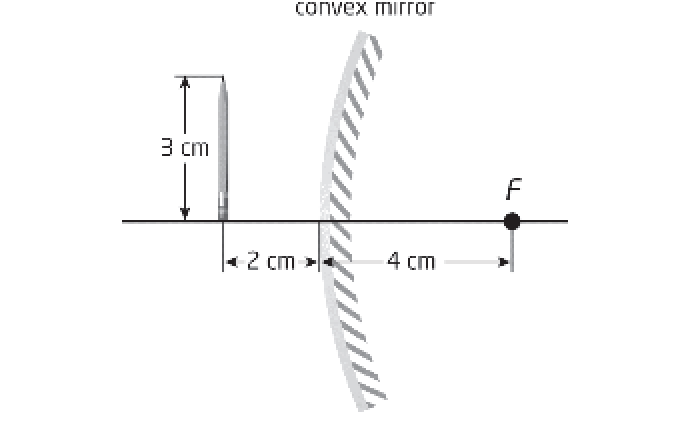
**Ray Diagrams**

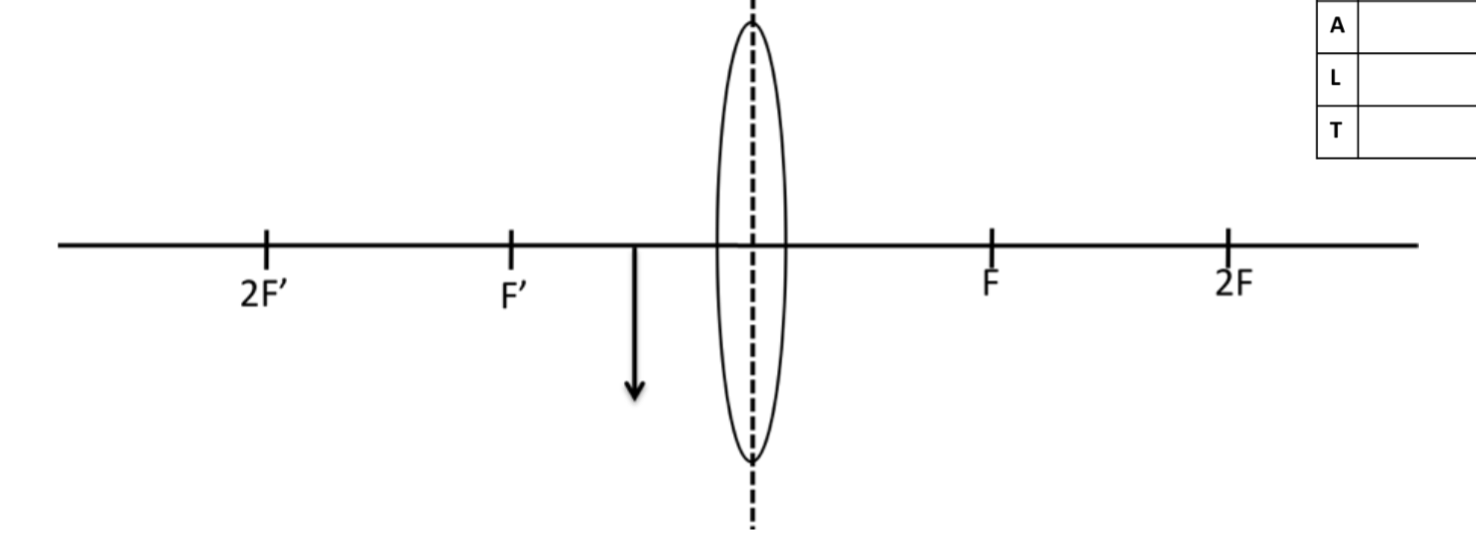
1. Complete the following ray diagrams. Don’t forget to include LOST.











**Calculations**

1. A small object is placed 50 cm from a concave mirror with a focal length of 20.0 cm.
   1. How far is the image from the mirror?
   2. Is the image real or virtual?
   3. If the object is 8.0 mm tall, how tall is the image?
   4. Is the image upright or inverted?
   5. What is the magnification?
2. A converging lens with a focal length of 25 cm is placed 18 cm from a candle. How far apart are the object and the image?
3. A 1.92 m tall student is looking at a convex mirror from a distance of 75.0 cm tht has a focal length of -12.0 cm
   1. Determine the image distance
   2. Determine the height of the image
4. A converging lens has a focal length of 8.0 cm. An object 3.0 cm high is placed 11.0 cm from the lens.
   1. What is the distance of the image from the lens?
   2. What is the height of the image?
5. An object 8 cm tall is placed in front of a diverging lens. An upside virtual image 4 cm tall is formed. What is the magnification of this lens?
6. The speed of light in water is 2.25 x 108 m/s and the speed of light in glass is 2.00 x 108 m/s. If the light travels from water to glass, would the light refract towards or away from the normal? Use a sketch to support your answer.
7. A 10 cm tall pencil is placed in front of a plane mirror.
   1. What is the height of the image?
   2. What is the distance of the image from the mirror?
8. An image is formed 19.0 cm in front of a diverging lens with a focal length of -20.0 cm. If the object is 1.40 cm tall, calculate:
   1. Height of the object
   2. Distance of the object from the lens
9. An object is placed 12.0 cm in front of a diverging lens with a focal length of -5.68 cm. If the image formed is 2.25 cm tall, calculate:
   1. Height of the image
   2. Distance of the image from the lens